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Understanding our changing relationship with space: an international political economy reading of space popularisation

1. Introduction

Outer space and the skies to which to turn our gaze, are as central to human existence as the earth upon which we stand. For millennia, we have imagined outer space, and drawn on space for artistic, cultural and religious inspiration. However, the twentieth and twenty-first centuries have altered our perception of space: outer space is no longer solely the remit of myths, legends and changing religious beliefs. Mankind has been to space, has harnessed near outer space for popular usage and has turned the basis for mythology and mystery into an aspect of our earthbound existence. Indeed, space-activity not only forms the basis of much popular fiction, but also provides material for contemporary media events. The moon landings in the late 1960s and early 1970s saw the dawn of international, live televised broadcasting and secured the place of space-activity as an element of pop-culture. Moreover, the popular use of space exploration to sell products, and the ever-increasing use of downstream space technologies and space-based satellite communication tools means that space-activity is as ubiquitous to 20th and 21st centuries as the capitalist consumerism it relies on for continued funding and the products that space-activities promote and advertise.

How we relate to outer space relies on dominant understandings which hinge on the knowledge to which we are exposed. Space-activity is no longer based only in 'science fiction', nor reserved for astronauts and astronomers. Access to the internet, television and inexpensive telescopic equipment, alongside engagement with the products of space technology, means that popular interaction with space is an ever evolving and growing phenomenon. Early interactions with space based religious festivals on the cycles of the moon: for example, early Christianity tied the Easter festival to the "Sunday following the full moon which coincided with, or fell next after, the vernal equinox" [1]. As space technology has increased, so too has our understanding of the realm beyond our own, and as technology has spread, so too has public engagement. Although we have looked to the skies since time immemorial, the twentieth century was as a watershed period for space engagement: outer space became a tool in the Cold War, and with that, a tool not only of military strength, but also of power through knowledge, ideals and dominant discourse. As such, notions of

outer space entered the lexicon of popular culture, featuring in art, music, film and the cultural sphere of the mid-twentieth century.

The first moon landing in 1969 precipitated enormous global enthusiasm for space and its technologies. However, other events, wars, recessions and depressions have prevented both the continued excitement, and continued manned space flight to the moon; as Smith notes “By the end [of the Apollo moon landings in 1972]...recession was bearing down and a darker harsher world was emerging” [2]. However, despite the drop in public space fervour and indeed in conscious interest in space-going activity, public, albeit often unconscious, engagement with space has in fact increased exponentially with the increase in space based technologies such as the GPS network, satellite television, mobile phone use, widespread broadband availability, and use of mobile 3 and 4G internet services. This paper argues that although we have seen a drop in the pop-culture use of space as a topic of interest, we have not seen a drop in public engagement with space, or public usage of space based technologies: what we have seen is a shift in engagement with space from an ideals based knowledge structure to a production based knowledge structure. We argue that this may be termed a technological shift: from conscious engagement and discourse formation in the 1950s and 1960s, to an unconscious technological engagement in the 2000s and 2010s.

Acknowledging that popular engagement with outer space has increased with the spread of space-based technologies, this paper establishes a two-fold understanding of the term ‘space popularisation’, linked to the political-economic structures of knowledge, power and hegemonic dominance. First, this article notes that the popularisation of space can be discussed in terms of the use of space and space activity by authors, poets, artists, and musicians as inspiration: thus popularising the topic of space while enhancing the cultural and artistic sphere in terms of what we may term an aspect of the cultural or knowledge structure of power. Second, this paper will emphasise the ever increasing and enhanced use of space for everyday communications, and the ‘popular’ use of downstream space technologies as everyday products. The spread of space based communication products, we class as the spread of knowledge and production, forming part of the important power structures outlined by Susan Strange.

This paper addresses theoretical debates based in the school of International Political Economy (IPE), using empirical discussion of space activity alongside theoretical debate, to analyse and examine both the issues of power and the global hegemonic knowledge structure, and the question of space activity, space use and popular engagement.

In a first section, this paper will address questions relating to power, the relationship between different forms of power and critically evaluate theories of power and the extent to which we can apply their major tenets to the issues of space activity and its popularisation. This section will then provide a critical overview of Susan Strange's work, focusing largely on her four structures of power as outlined in her seminal work "States and Markets" [3]. From this, we take a closer analysis of one particular power structure, the knowledge structure, and ask; to what extent and in which specific ways does the knowledge-as-power structure impact on space popularisation, and vice versa?; is it impacted upon by the exploration of space? In a second section, this article will explore aspects of the history of public engagement with space, and space popularisation. In this section, knowledge is addressed in two ways: first in terms of knowledge as ideas, ideals and ideology, the extent to which popularisation is used to form dominant discourses and cement political ideology; second, knowledge is addressed as it combines with the production structure to create what we term, technology. In a concluding section, this paper suggests that a shift has occurred from knowledge as ideals and ideology forming the basis for space popularisation to knowledge as technology forming the basis for public engagement with space.

2. International relations and space power

The politics and international relations of space activity is an area of academic study that has not yet attracted wide-scale discussion. As such, this area of analysis does not have the theoretical basis that has developed around other, land based, aspects of international relations. Subsequently, to analyse relations in space we must borrow frameworks of analysis from other cognate disciplines. This article thus discusses power, realist political structure and the international political economy, to develop a framework of analysis which allows the analysis of international relations in space. Starting with a general analysis of power, this section will then move to a realist reading of power before addressing Susan Strange's interpretation of the international political economy, through which we establish the basis of evaluation for this paper.

Power is central to space activity and space exploration on several different levels, from the political to the physical. According to NASA, the USA's national space agency, "the three Space Shuttle Main Engines, in conjunction with the Solid Rocket Boosters... consume[d] liquid fuel at a rate that would drain an average family swimming pool in under 25 seconds generating over 37 million horse power"

[4] as they propelled the Shuttle spaceward. Alternatively, we can define power as a precise astrophysics equation used to generate the calculations necessary for space flight. In this sense, power can be calculated as work / time: “power is the work done in a unit of time... a measure of how quickly work can be done” [5]. These conceptions of power are essential to the space sector, and are therefore essential to the contemporary forms of popular engagement with outer space that require hardware to be sent to, and to operate outside, the earth’s atmosphere. However, in space, we see several different important forms of power at play: power has political, economic and social synonyms of equal importance to the space sector; these relate to states, international relationships, public private partnerships and cultural development. If we look to International Relations (IR) theories, and theories of international political economy, we begin to understand what power is, where it comes from, and why it truly is central to space exploration, travel and activity.

2.1 Space relations, international relations

The analysis of international relations played out in space not only suffers a paucity of theoretical discussion due to its relatively recent appearance on the academic table, but also due to the state, and land, based assumptions made by most relevant frameworks. That is not to say that such discussions are, however, irrelevant. Although realist conceptions of international relations consider the state to be the main currency of international political interactions, they also understand sovereignty and security to be the commodities that are most clearly sought [6], issues that are also at the heart of space power and space politics. And, while the international relations, or geopolitics of outer-space may be considered by some theorists to surpass the sovereign limits of the state – as Pfaltzgraff [7] notes “what is unique about space is the fact that we are dealing with infinity. Whereas the terrestrial land mass and the seas have knowable finite bounds, we literally do not know where space ends or understand the implications of infinity or how we theorize about space” - others argue that statist and global debates are relevant to any area in which states fight for supremacy and influence. On this, Herzfeld [8] notes: “Because of the strategic value of space...space commands special importance and has become a critical national resource”. Moreover, reaching outer space, and all business conducted in outer space is done either by nation states or corporations acting along state based assumptions of global power relations. Theories of international relations and geopolitics cannot therefore be ignored despite the area of discussion lying outside the traditional realm of the ‘state’ or indeed the international arena. Pfaltzgraff [7] further notes that “Because all IR theories either *describe* or *prescribe* interactions and relationships, space becomes yet another arena in which to theorize about the behaviour of the world’s political

units”, and that the worlds’ political units, be they states or non-state actors, seek power. All space activity is therefore carried out by power seeking political units, or wealth seeking corporate units: as Pfaltzgraff [7] tells us, “Space is an arena in which competition and cooperation are already set forth in terms and issues reminiscent of Earth-bound phenomena. Space power includes assumptions drawn from IR theory.”

Indeed, if discussing *Earth-bound phenomena*, we should note that our near orbit, or inner usable atmosphere, might be considered *earth space* rather than *outer-space* given our use of the area, its proximity and its distinction from the rest of the unknown and unusable universe. Indeed, we can compare its use to other important trade, transport and communication routes or tools. Leissle [9] notes that “this has happened earlier in history” and draws a comparison between space and notions of the ‘high seas’. Leissle discusses the development of international regimes for space, via analysis of naval power from the sixteenth century to the early early twentieth century as regards the assumption that states require access to both for economic, social and security advancement and provision: all areas in which the state and other actors have rational and clear objectives to fulfil. On such a view of space, we note that its popularisation is moot: space is essential to contemporary politics and modern, everyday life.

2.2 The power of popularisation

Regarding the relationship between power and popularisation, Dolman in his 2005 analysis *Astropolitik* [10] notes that public perception of space exploration and activity has largely been mistaken. He suggests that “The popular vision of the exploration of space...is that of a cooperative effort by all humanity...It has certainly not been perceived in terms of the statist *Astropolitik* model here associated with the harsh and competitive diplomatic doctrine of *Realpolitik*. But that latter mode undeniably was the vehicle that propelled mankind into space”. On this view, we note that while the popular view of space exploration traces a liberal International Relations trajectory, the state view of space activity is largely based in realist ideology. Given this, we might surmise that popular opinion, popularisation, and the popular knowledge structure is less important to space power than other modes and structures of power – namely military power and security advantage. Given the focus on realist conceptions of state interactions in space, several other authors have suggested drawing upon nineteenth century and early twentieth century models of analysis for sea power in discussing and analysing space power. Indeed, if we apply high seas theory

to the issue of space politics and space international relations, we can shed some light on multi-lateral, bi-lateral and state-commercial relations that come with this area of study.

Jon Sumida in his essay *Old Thoughts New Problems: Mahan and the Consideration of Spacepower* [11] presents an application of Mahan's theory *The influence of sea power upon history* to space. In seeking an applicable theory for space power and the challenges it poses, Sumida discusses two important aspects of Mahan's high seas theory. First, he notes that if any side in a dispute possessed "absolute sea command or, in special cases even temporary local control, naval operations in direct support of land forces could be of decisive importance" [11]. Second, Sumida notes Mahan's argument that technological improvement could never eliminate the "tactical and strategic uncertainty from the conduct of war" [11]. These three problematiques draw Sumida towards a series of applications of sea power theory to space: he suggests that space activity will have "large and growing economic effects and will therefore be highly significant for the economic future of the United States" [11] and we would assume, be highly significant for other powerful states. He further notes that "The security requirements of space based economic activity will involve costs that are beyond the means of any single nation state" [11] thus suggesting that based on the experience of sea-power challenges, interested states will need to form cooperative associations, bi-lateral or multi-lateral agreements to benefit fully from space activity. However, Sumida further notes that the development and defence of space activity will be "largely determined by private capitalism and other nation-states with major interests in the space economy" [11]. He thus suggests that the era of state based space exploration may be coming to an end, and that we should expect the start of an era of multi-lateral cooperation and private finance in space exploration and activity. This is already evident in examples such as Elon Musk's *Space X* and Richard Branson's *Virgin Galactic* projects.

Where the core of Alfred Thayer Mahan's sea power argument is the relationship between the economy, the state and the military power of the national navy, Sumida [11] notes that the issues that prompted Mahan to write, are very similar to the challenges presented today by space. Indeed, as Sumida notes, the interconnectedness and the "relationship between the economic basis of national strength and the development and effective use of a navy" [11] are reminiscent of the International Political Economy's (IPE) assumptions regarding the interconnectedness of wealth, security, production and knowledge / ideas. These assumptions sit at the cross roads of analysis for space activity, and any analysis of space must therefore take these, and their accompanying theories of International Political Economy, into consideration.

Although theories of International Relations are important to the issue of space power and space popularisation, their realist beliefs and liberal interconnectivity assumptions fail to take into account the power of ideas and ideology. To address this gap, we now turn to Susan Strange's interpretation of international political economy, which, with its clear focus on several facets of power including that of ideas and ideology, serves to provide a more detailed discussion.

3. Strange Times: Space, Power and the International Political Economy

As noted above, liberal and realist conceptions of power in IR can shed light on many political situations, and indeed can aid understanding of space power through application of nineteenth century theories on sea power. However, to fully understand the geopolitics of space and popular engagement with space it is essential to look more deeply at international power relations. Theories of International Political Economy (IPE) and the analysis of power in the global system that accompanies such theories, provide a useful theoretical framework and contextual backdrop through which to examine the question of space knowledge and space popularisation. The particular conception of power used in this analysis is derived from Susan Strange's works on hegemony, structural power and the relationship between states and markets. Lieberman [12] argues that space activity and exploration have occupied an important place at the centre of the International Political Economy's (IPE) structures of *power*, as discussed by Susan Strange, in terms of military, security, wealth, finance, production, knowledge, ideas and discourse. This paper argues that since the middle of the twentieth century, over and above its contributions to science and technology, space activity has contributed to the production / knowledge structure through downstream technologies and public engagement with space-based products and services. Furthermore, looking through the lens of IPE power structures, we note that space activity has demonstrated its worth to the knowledge structure through arts, culture, film, television, literature and music.

Strange informs us that hegemonic power resides in four "interacting structures" [3], each facet touching as in a four sided pyramid. She suggests that structural power resides in "control over security; control over production; control over credit; and control over knowledge, belief and ideas" in a manner that "each is supported, joined to and held up by the other three" [3]. Other articles have emphasised the importance of Susan Strange's work on power for the space industry, and space going technology. Lieberman [12] emphasises the extent to which space activity demonstrates the importance of, draws on and advances power in all four of these hegemonic power structures,

suggesting that space activity is a prerequisite for those states with hegemonic, or power ambitions. However, while we might assume that power is gained, achieved, used and played with mostly in terms of military and finance, holding structural, hegemonic power requires much more than brute force. First and foremost, to display hegemonic power, and to create the weapons required to have military dominance, involves having the best ideas and the most inspirational technology. To do this and retain the support of the populace requires winning over the hearts and minds of the people. Space technology is the fulcrum at the centre of the four power structures: it requires the power of great knowledge, ideas and ideals; it provides security; it requires, demonstrates and creates wealth; it demonstrates and advances production, and its technology and technological advances can be seen both to create knowledge, while simultaneously requiring knowledge.

3.1 Pop power

It is therefore clear that, space power is important to international relations, and that it relates to the military and security aspects of both relational and structural power. However, if we return to Susan Strange and her four inter-connected spheres of power, finance, military, knowledge and production, we note that winning the hearts and minds of the people, or winning the cultural or 'ideas' battle is arguably the most important aspect of state power, and a hugely important aspect in terms of gaining and maintaining global power and influence. Ideas, and the popularisation of ideas, are therefore central to any theory of power, and space power is no different.

To analyse the popularisation of space, this paper will now adopt a two-fold perception of knowledge and power. First, knowledge in terms of ideals, ideological discourse, pop culture, art, music, film, and its propagation of "beliefs and ideas" as defined by Strange. Second, knowledge as "technology" in terms of its definition by Lawton, Rosenau and Verdun [13] as "the application of knowledge in production". These two conceptions of knowledge and power form two connected ways in which we can view space exploration and activity.

4. Knowledge: ideas and technology

Human desire to understand space, reach space and use space has provided centuries of clear and focussed impetus for breakthroughs in science and for great technological development. However, science and technology are not the only spheres that have been greatly influenced by space. Space exploration, activity, and desire have also had an important and significant impact on contemporary

cultural history through the inspiration outer space provides to the arts and popular culture. Moreover, achievement in space, the breaching of the final frontiers to which humankind has gazed for millennia, has had a cultural impact cementing political ideals and creating the foundations of structural knowledge patterns that will outlive current geopolitical strategy and corporate input.

Drawing on the above discussion of power and the international political economy school of thought, this analysis will now turn to an examination of space activity from an 'ideas' perspective and a 'technology' perspective. This will provide a clear analysis of state power and geopolitical power in terms of ideas, ideals and space culture; and in terms of knowledge and space technology. Both form part of the knowledge structure as outlined by Susan Strange in her iconic work *States and Markets* [3] but incorporate different aspects for discussion. In this second section, we will first look to the power accorded to states through the formation of ideas, beliefs and a dominant discourse based on space; and second, discuss the power potential of technology. As Lawton, Rosenau and Verdun [13] note, "Technology is generally defined as the application of knowledge in production": which, using the IPE framework discussed, can be described as the meeting place of the knowledge and production power structures [3]. In a final concluding section, this paper will aim to answer the question of whether greater power is conferred on the holder of knowledge power as ideas, or knowledge power as technology.

4.1 Knowledge as ideas

Susan Strange defines power through four important structures, and classes knowledge as ranking alongside production, wealth and security in terms of importance [3]. Space is hugely important to the structures of production, wealth and security, but is also linked closely to the knowledge structure through its role in terms of technology advancement and value production, which many would argue, lies at the epitome of any power structure.

Throughout history, space has been present in the lives of human beings. As such, stories have been told, ideas formed and ideologies created around outer space which have combined to create different forms of power. Indeed, although the twentieth century saw great leaps forward in terms of space travel, space exploration, scientific knowledge and popular engagement with space, the 'popularisation' of space began much earlier, and space has long been 'popular' with mankind. As Makemson [14] observes, "No one knows, of course, how many thousands of years have elapsed since men first began to wonder about the sun moon and stars, but the great wealth of

archaeological material having an astronomical basis from Asia, Africa, Europe and the Americas leads one to the conclusion that there came a time in human history when men looked upon the heavenly bodies as sublime powers from whom their sustenance came and on whose benevolence their whole existence depended". The stars and celestial bodies have been a source of fascination, myth and religion since the times of the earliest found forms of records and rock engravings, and no doubt earlier.

4.2 Knowledge and popular culture

In contemporary times, interest in space going pursuits seems to have waned. However, the impact of space on culture and our cultural understanding of dominant discourses and ideals appears to not have followed suit. Indeed, it could be noted that in the twentieth century we witnessed a spike in what we may term 'space interest' or space popularisation, and despite a drop in easily observable space activity, the twenty first century has seen space become more, rather than less, important to global populations. In terms of knowledge, as ideas, ideological thinking and as an enabler of cultural thinking, we cannot overestimate the contribution made by space. Within the arts and our more general understanding of historical and contemporary cultural heritage, space exploration and space travel have had an impact like no other subject matter, illustrated by the increased number of space outputs at times of particular interest. For example, the profusion of science fiction films released during the 1960s illustrates the impact that space exploration had on the arts of the time, and correspondingly, the impact space had on the ideas and dominant ideologies of the time. While cinematic representation of outer space is popular, because, as King and Kryzwinska note, it "deals with the problems and promises offered by science, technology and rationality" [15]; other aspects of the arts sector have also drawn upon outer space for inspiration. David Bowie, always the zeitgeist, recorded *Space Oddity* in 1969, one month before Apollo 11 landed on the moon: as *Billboard* notes, "Bowie's early embrace of science fiction was a sign of the times" [16]. Bowie's influence has continued to the present day through a new audience and the rise of social media.

Chris Hadfield, while on the International Space Station (ISS) gave us an insight into his own outer-space life, and re-popularised David Bowie's space musings: his "zero gravity version of...*Space Oddity*" received over 10 million views in its first three days online" [17]. Although it is supposed that conscious interest in space activity has waned since the 1960s, through their engaging use of social media Hadfield and later Tim Peake, have increased awareness of space exploration for a whole new generation. In 2016, Tim Peake reignited the imagination of the British population by

completing a space-walk, running the London Marathon from the ISS and talking directly to school children [18] thus recreating a dominant discourse of interest in space, and promoting the idea that the knowledge production, the science and the technology needed for space exploration are worth the financial expenditure.

4.3 The celluloid space

Regarding the use of film, to which we suggest adding the newer concept of social media, to promote ideological aims or to create and cement dominant discourse, Dodds notes that the use of politics in fiction, film and music is an important cultural phenomenon, and acknowledges that it has had an important impact on the study of international relations. He tells us that “Over that last ten years [from 1995 – 2005], disciplines such as International Relations (IR) have embraced the so-called ‘return of culture’ in a variety of ways. It has been raised not only as an issue of forthcoming insecurity in the form of civilisations and corresponding clashes, but also in the context of how popular culture might influence/shape/reproduce the foreign and security policies of governments” [19]. In this vein, we might suggest that the moon landings provided the ultimate back drop for the Cold War. Indeed, within the discipline of international relations, the Cold War is recognised as a war for hearts and minds, or ideas and ideals, as much as it was a war for territory or geopolitical strategic gain. While the USA and the Soviet Union fought for state based supremacy both on land and in space, and achieved new heights in technological development, corporations, film, music and cultural iconography adopted space as a watchword for both forward looking modernity a new found cultural insecurity [20]. Given the different uses and interpretations of space activity, the cultural adoption of space sought to cement political ideology in cultural output and thus provides interesting clues to societal interpretations of International Relations.

More specifically, we note that the politics of the bi-polar power structure has enjoyed a variety of fictional representations, from James Bond to American science-fiction. For Robert Heinlein, the Cold War has provided the backdrop, and space the inspiration for many works. Heinlein’s 1949 novel *The Long Watch* dealt with “an attempted military coup on the US Moon Base” [19] while his 1950 screenplay *Destination Moon* charted a space race between the USA and the Soviets, and emphasised “the strategic importance of near space” [21]. The use of the Cold War in films and literature, emphasising the Soviet Union as threat, has continued. As Dodds notes, Bond films are “filled with explicit references to so-called allies and friends (e.g. the United States) and adversaries (e.g. the Soviet Union and China)” and are “always sensitive and sensitised by the prevailing Cold

War conflict” [19]. But action is not the only genre to use space and Cold War themes. King and Kryzwinska note that “science fiction dominates many of our movie screens and can be seen as a powerful cultural barometer of our times”, indeed, as they further note, it is a genre which “extends into a wider range of industrial, historical and cultural contexts” [15].

The impact of space on our contemporary cultural history and our understanding of political relations is hugely important. However, while the impact of space on culture and especially film is instantly clear, the impact on politics and international relations may be less so. If we return to Susan Strange [3] and her four structures of power, we note that the knowledge structure is always as important as the structures of wealth, security and production. If this is the case, then the use of space to form ideologies, create discourse and develop popular cultural awareness is paramount to the successful harnessing of power in politics and international relations. During the Cold War, and indeed since, space has come to form an essential part of our cultural story: tied as it is to discourses of alliance and enmity, technological prowess and modernity.

5. Space Technology: knowledge as a transformative force

Not only is space tied closely to the generation of discourse, cultural ideas and ideologies, but it has provided the motivation behind the creation of knowledge and the production of technological manufacturing know-how, and has done since Lippershey and Galileo Galilee sought to create an instrument through which to view the stars in the seventeenth century. Indeed, the advancement of technology due to humanity’s desire to reach and understand the stars cannot be understated. Identifying technology as a concept brings together two of Susan Strange’s structures of power, knowledge and production and is central to the analysis of space and its ‘popularisation’; most specifically to the increased use of space hardware and ever deeper public engagement with space-based technologies. Strange does not discuss technology development *per se* within her *States and Markets* analysis; she does, however, develop the idea of “secondary power structures” [3] a title she assigns to the areas of transport, trade, energy and welfare, and a title that Lieberman [12] suggests would be attached to communication technologies was Strange writing today. Ideas, innovation and inspiration promote technological advance, and in terms of military interventions, technology innovation is often precipitated and accelerated by war. If we look to the closing scenes of the Second World War, we see this process clearly. The accelerated advances made in space technology and space exploration perfectly illustrate the importance of the knowledge structure,

alongside the power structures of production and wealth, coming together create defence: i.e. to use Strange's terminology, great power in the production and knowledge structure combining to provide power in the security structure [3]. Indeed, we argue that space was popularised as a tool to demonstrate technological superiority during the Cold War and continues to be used for this purpose today.

5.1 Knowledge as ideas versus knowledge as technology

Knowledge, whether discussed as ideas, ideals, ideologies, discourses or production techniques, is a difficult concept to quantify and a difficult medium to transfer, steal or adopt. As Lawton, Rosenau and Verdun note, "The cumulative and firm specific nature of knowledge means that there are no quick fixes to the learning process, nor is it easy to leap frog, as frequently assumed into totally new areas of technology" [13]. They further go on to note that "technology is not only embodied and codified but has a large tacit element to it. Tacit knowledge refers to those aspects of technology that are embodied in the organisational routines and collective expertise or skills of individuals and teams [13]. To be in possession of knowledge in terms of holding the dominant discourses, beliefs and ideas is important; however, to be in possession of knowledge in terms of holding the preeminent scientists, technology and production skills, confers a huge power on the proprietor. This is not a new phenomenon, and regarding space power is clearly observed in the immediate post WWII 'space race'. Cadbury [22] tells us that "In the midwinter of 1945 [as] the war in Europe...reached its final stages", the USA and the USSR fought to locate and liberate the V2 blueprints and those with the know-how to use them. While several of von Braun's scientific team aimed for the imagined safe haven of American territory, the USSR's "State Defence Committee set out plans to coordinate the activities of the army and the [People's Commissariat for Internal Affairs] NKVD in the search for German weapons technologies" [22]. The aim of each state power was to use the Nazi blueprints, with the 'tacit knowledge' embedded in Wernher von Braun and his team. Both nascent superpowers were thus in 1945 aware of the power conferred by space technology and the tacit knowledge required to reproduce Nazi technologies. This continued understanding meant that the Cold War was a time of vastly increased military spending and accelerated technological advancement as both sides aimed to achieve a higher level of knowhow and production.

It is clear that scholars will encounter problems in the application of traditional international relations theories to outer space: as Pfaltzgraff argues, "There is as yet no comparable basis for developing and testing theories about political relationships in space" [7]. However, drawing on

Dolman's *Astropolitik*, he suggests that "geopolitical theory developed for the Earth and its geographical setting can be transferred to outer space" with the "strategic application of new and emerging technologies within a framework of geographic, topographic, and positional knowledge" [7]. This he argues, as we noted above, should be compared to those geopolitical theoretical constructs used to analyse nineteenth century naval power, a large aspect of which is the notion of prestige or reputation. The concept of 'prestige' combines knowledge as ideas – urging other states to believe in the dominant discourse of your power – and knowledge as technology – persuading other states that your higher level of technological knowhow confers military and financial superiority. If we acknowledge that IR theory can be applied to space activity, we might divide the structures of power into hard and soft power as international relations scholars do, and in doing so, we see that 'spacepower' draws on both. The hard power aspects are clear – the security threat posed by satellites, the unknown quantities that are space launches and the knowledge that such technology belies a great military prowess. The soft power aspects of space exploration are less explicit. However, as Lewis notes, "Space programs are an element of soft power; they provide prestige and technological prowess that can be turned into influence and leadership on the international stage" [23]. He goes on to remind us that in terms of prestige, space is the ultimate soft-power tool by noting that "When NASA manages to launch a shuttle, the world is reminded of America's technological prowess" [23]. This high level of security and military prestige gave the USA a clear advantage during the Cold War. Indeed, on space issues, whether either side had an *actual* military advantage was considered less important than the prestige advantage conferred by succeeding where the other failed. The Soviet Union's Sputnik success gave rise to widespread questioning of the fundamental ideals of liberal capitalism, while the tenets of liberal democracy and capitalism were shown to have produced the most technologically advanced event in history when the USA's Apollo 11 mission landed humankind on the moon.

Although the Cold War space race is now technically over, the competitive nature of state based innovation in space technology is not. However, we note that the way in which technology is promoted and used has changed. Andy Green, of UKspace, notes that "The UK space sector punches above its weight globally and continues to grow much faster than the UK economy. Space is a high growth, high productivity sector where targeted government investment generates further industrial investment and creates highly skilled jobs. It is a key enabler that is critical for our national economy" [24]. Where previously states fought for the 'hearts and minds', the ideas, ideals and ideologically based dominant discourses, and used success in space as demonstrative tool, contemporary space sectors have adjusted to see space as an economic 'enabler'. This change is

observed by by Koepping –Athanasopoulos who notes that “Budget allocations for the exploration of the solar system as well as for human spaceflight have stagnated... While ESA’s overall budget has vastly increased over the past eight years, it appears as though policy-makers are interested in space applications, rather than in space exploration” [25]. The common usage of space hardware and exponentially increased public use of space technology has huge implications for private markets as well as public facilities and government and most space activity in contemporary society is based around the design, launch, maintenance and running of satellites in earth’s orbit. Indeed, the importance of satellites has increased exponentially since Sputnik made its name circumnavigating the earth. Today the military, global transport networks, the global financial markets and the world trading system all rely on global positioning technology and satellite communication to function. Of note, although many satellite launch companies are privately owned, or of public-private partnership status, the majority of launch facilities remain state based, or intergovernmental in nature, and “also have a wide range of productivity enhancing effects on other sectors” [24]. Therefore, as competition increases for capital and private investment, it could be argued that recent innovation in state based space activity is driven by the private sector’s need for efficient, safe and timely launch facilities, and by governmental desire to see overall, national economic growth. The need to persuade the population of the superiority of ideological stance or knowledge base, has, it would seem been somewhat replaced by a need for innovation and technological advancement to provide the best service to the private sector and to find high tech solutions to new problems as they arise. Society may have lost the romantic attachment to space activity, but we have gained important technology.

5.1 knowledge as pop power

It may not be the romantic notions of space, or its incorporation into the artistic realm that has led to the re-ignition of space activity as a popular topic. The extent to which extra-earth placed technology has entered the realm of necessity is equally important. Populations demand internet connection as a Human Right; our powers of free expression and communication require the ability to communicate instantaneously around the globe; and interference to satellite communication structures would thus be considered a breach of fundamental rights. Such is the importance of this new level of structural communication for the military, the global market, transport, trade, human development and human rights, that the interference or cessation of such services is considered a tool of warfare. Space, in relation to Strange’s structures of power, may thus be in the process of

change: we may argue that we are shifting from a knowledge power base, to a power structure based once again on militarization the economic power structure and the production structure [25].

However, although militarization and the economic power structure do not seem largely compatible with the notion of *popularisation*, or Strange's ideals and ideology knowledge structure, Cuarón's 2013 space debris thriller *Gravity* demonstrated the fact that space remains a popular topic. This recent block-buster highlighted the need to examine this issue further, to create the technologies required to decommission satellites safely and successfully, to remove debris from space and to create policy in support. The days of space innovation are not over, they have entered a new phase, perhaps a new pragmatic phase, where new problems require solutions, where films address the exciting issues of the day. Only when we are no longer interested in space, or in the technologies we have based in space, will innovation cease, and will popular culture stop drawing on space activity for inspiration.

6. Conclusions: geopolitical strategic space

This paper has sought to demonstrate the importance of space to humankind, and to discuss the means by which space has been used and popularised at different times, in different ways to explain, to help build a knowledge base, to develop dominant discourse and to bring together communities. Although space uses, enhances and draws upon many different conceptions of power, the knowledge power structure is arguably the most important to contemporary analysis of space exploration and activity. This paper has outlined the importance of different conceptions of power in space, looking at Susan Strange's IPE power structures, concepts relating to sea-power and Dolman's seminal 2005 *Astropolitik* theory. Through analysis of the knowledge structure within the concept of international political economy theory, space activity has been shown to incorporate different forms of knowledge: knowledge as ideas and knowledge as technology.

Knowledge in terms of ideas, ideals and technology is central to our understanding of space exploration and activity. It is also central to political discourse. Politicians are accountable to the public, and although space may appear to be minor aspect of public policy, it can be a very costly element. Moreover, legitimization of government policy and ideology in terms of knowledge, wealth, production and military can come from a successful space programme. Indeed, we should note that as a structural component of the international political economy, winning the 'hearts and minds' of the people is an incredibly important factor in the cultural imperialism that promotes social and

political hegemony. From John Donne to David Bowie, popular European artists have used outer space as inspiration; while Star-Trek, Star Wars and other Hollywood sci-fi franchises owe outer-space an enormous cultural debt.

Knowledge as an aspect of production and technology is also a fundamental requirement for space activity. This is scientific, technological, production-enhancing knowledge, without which space exploration is impossible. The importance of space is further enhanced by the fact that the means by which knowledge is transferred and communicated is now largely space based: internet, television, radio, mobile phone, and broadcasting is dependent on satellite communication. While this aspect of space knowledge is less attached to the cultural facets of beliefs, ideals and ideas, and more closely aligned with technological or scientific breakthroughs, it nonetheless is of significant importance to states and individuals.

The two different forms of knowledge meet in space. While Cold War rockets and the threat of intercontinental destruction increased prestige and military power, the popularisation of the space race did much to promote respective political regimes and ideology. In 1957, the Soviet Union launched their satellite Sputnik, a non-military orbiter designed to parade technological know-how. Despite American confidence in their knowledge production and superior liberal capitalist ideas, the Soviet Union achieved satellite launch first. Militarily, Sputnik itself did very little; however, socially, politically and in terms of power relations Sputnik was a game changer. The success of Sputnik left the US, its politicians and citizens questioning the utility of not only their scientific and military expertise, but also questioning liberal capitalist democracy. Knowledge as ideas, and knowledge as technology underpinned the Cold War.

Technological advancement, accelerated by the twentieth century's love affair with worldwide warfare, may mean that it is remembered as the century of space rather than the century of destruction. Space was truly popularised: from the global excitement of the moon landings, to widespread popular engagement with space based technologies, the global population is now more fully engaged with space than at any previous point in history. Although perfecting launch facilities for use by private corporations may not be the most romantic of engagements with space, the altering relationship between state and market has required this shift. Nonetheless, however, space activity and exploration continues to light up the public imagination.

This paper has examined the popularisation of space as part of a system of knowledge power, evaluating the importance of ideas and ideals in the cultural arena; and examining state based domination of production knowledge and technology. We have focused on Susan Strange's *States and Markets* analysis of the International Political Economy [3] addressing structural power and knowledge. If we should continue this discussion, we must examine the historical links between space technology and pop culture, to ask: is popular 'knowledge' more desirable than scientific 'knowledge'. Alternatively, does popular 'knowledge' help us to disseminate technological information? Do we need the filter of popular culture to create a cultural identification with outer space? Moreover, in this technologically advanced era, can we have a direct relationship with space and space technology that does not require the filter provided by the arts? Mankind has a changed relationship with space. We have made that one huge step onto the moon, and we have become reliant on space based technology. What now remains to be seen is whether our interest in space will wane as it enters the realm of the everyday, or whether our ideals, prestige and power will remain tied to space as the technological aspects become ever more tied to economic success and military power.

References

- [1] E. Zerubavel, Easter and Passover: On Calendars and Group Identity, *Am. Socio. Rev.* 47.2 (1982) 284-289
- [2] A. Smith, *Moondust: In Search of the Men Who Fell to Earth* Bloomsbury London, 2005
- [3] S. Strange, *States and Markets*, Continuum, London, 1994
- [4] NASA, Space Shuttle Main Engines, NASA Space Shuttle System.
http://www.nasa.gov/returntoflight/system/system_SSME.html, 2009 (accessed 30.9.2016)
- [5] Edinformatics, What is Work, Energy and Power,
http://www.edinformatics.com/math_science/work_energy_power.htm , 2016 (accessed 4.10.2016)
- [6] T. Dunn and B.C. Schmidt, Realism, in J. Bayliss, S. Smith and P. Owens eds *The Globalisation of World Politics*, OUP Oxford 2014

- [7] R. Pfalzgraff, International Relations Theory and Spacepower, in C.D. Lutes and P.L. Hayes eds. Toward a Theory of Spacepower, Institute for National Strategic Studies, Great Britain. 2015
- [8] H. Hertzfeld, H Commercial Space and Spacepower, in C.D. Lutes and P.L. Hayes eds. Toward a Theory of Spacepower, Institute for National Strategic Studies, Great Britain. 2015
- [9] M. Leissle, Power, Politics and the Formation of International Law: A Historical Comparison in in eds. T. Hoerber and E. Siglas Theorising Space, Lexington London 2017
- [10] E. Dolmen, Astropolitik: Classic Geopolitics in the Space Age, Frank Cass, London, 2002
- [11] J. Sumida, Old Thoughts New Problems: Mahan and the Consideration of Spacepower in C.D. Lutes and P.L. Hayes eds. Toward a Theory of Spacepower, Institute for National Strategic Studies, Great Britain. 2015
- [12] S. Lieberman, Strange Spaces: an International Political Economy Reading of Operational Space Programmes in eds. T. Hoerber and E. Siglas Theorising Space, Lexington London 2017
- [13] T. Lawton, J. Rosenau, A. Verdun, A. Strange Power: Shaping the Parameters of International Relations and International Political Economy, Ashgate, Aldershot 2000
- [14] Makemson, M (1954) Astronomy in Primitive Religion J. of Bible and Religion, 22.3 1954, 163-171
- [15] G. King and T. Kryzwinska Science Fiction Cinema: From Outerspace to Cyberspace, Wallflower, London, 2006
- [16] J. Rosen, David Bowie as Starman: His Crucial Obsession with Space, Billboard 2016, <http://www.billboard.com/articles/news/magazine-feature/6843057/david-bowie-space-obsession> (accessed 30.9.2016)
- [17] C. Hadfield, An Astronaut's Guide to Life on Earth, MacMillan, London, 2013

- [18] A. Thomas, The Astronautical discourse in an English primary school during the Principia ESA mission: A Critical Analysis; (this issue) Space Policy, 2017
- [19] K. Dodds, Screening Geopolitics: James Bond and the Early Cold War Films (1962-1967) Geopolitics 10.2 266-289, 2006
- [20] S. Lieberman, Are The Days Of Innovation In Global Space Over, or Just Beginning Room: The Space Journal 2016, <https://room.eu.com/article/are-the-days-of-innovation-in-global-space-over---or-just-beginning> (accessed 30.9.2016)
- [21] D. Seed, American Science Fiction and the Cold War: Literature and Film Routledge, London, 1999
- [22] D. Cadbury, Space Race: The Battle to Rule the Heavens Harper Collins, London, 2006
- [23] J. Lewis. Neither Mahan nor Mitchell: National Security Space and Spacepower in C.D. Lutes and P.L. Hayes eds. Toward a Theory of Spacepower, Institute for National Strategic Studies, Great Britain. 2015
- [24] UKspace "IGS UK Space Innovation and Growth Strategy: 2015 Update Report, UK Space, 2015, <http://www.ukspace.org/wp-content/uploads/2015/07/Space-IGS-Report-Update-July-2015.pdf>, (accessed 30.9.2016)
- [25] H. Koepping-Athanasopoulos, Europe's New Wilderness: The Council's Frames on Space Policy in T. Hoerber and P. Stephenson, European Space Policy, Routledge, London, 2016